11-14-2016

The Amulet Wearable Platform: Demo Abstract

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Demo Abstract: The Amulet Wearable Platform

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ABSTRACT

In this demonstration we present the Amulet Platform; a hardware and software platform for developing energy- and resource-efficient applications on multi-application wearable devices. This platform, which includes the Amulet Firmware Toolchain, the Amulet Runtime, the ARP-View graphical tool, and open reference hardware, efficiently protects applications from each other without MMU support, allows developers to interactively explore how their implementation decisions impact battery life without the need for hardware modeling and additional software development, and represents a new approach to developing long-lived wearable applications. We envision the Amulet Platform enabling long-duration experiments on human subjects in a wide variety of studies.

1. INTRODUCTION

Wearable wristbands are increasingly popular devices for health and fitness sensing, and the increasing variety of applications is driving the market from single-function devices (like the Fitbit Flex) toward multi-application platforms (like the Apple Watch or Pebble Time). These devices enable new sensing paradigms; they are worn continuously, they can interact through a body-area network with computers, smart phones, and other wearables, and they can provide at-a-glance information to the wearer.

Battery lifetime is one of the most important features for mobile and wearable devices. Users want long-lived wearables that they rarely charge, but without sacrificing interaction quality. Developers need tools and platforms that enable understanding of their applications impact on battery lifetime.

The Amulet Platform[1]. aims to address both these needs. The platform enables devices (shown in Figure 1) that have the week-long or month-long battery lifetimes of a smartband with the multi-application flexibility and full-featured development environment of a smartwatch. This is coupled with developer tools (shown in Figure 2) that give insight into energy efficiency, and forecast battery lifetime.

Figure 1: Perspective and interior views of our open-hardware wearable device, part of the open-source Amulet Platform. The platform supports development of energy-efficient, body-area-network sensing applications on multi-application wearable devices.

The Amulet Platform is comprised of four main parts; 1) The Amulet Firmware Toolchain, a firmware-production toolchain that guarantees application isolation (protecting the system and applications from errant apps). The Amulet Firmware Toolchain manages developer code, and the runtime, to produce firmware that can be loaded directly onto the device. 2) The Amulet-OS Runtime, a multi-application runtime system for resource-constrained wearables that is built on a low-power variant of the QP event-driven runtime. The runtime supports interfaces with all sensors, BLE, storage, and the user interface. 3) A graphical tool called ARP-View that helps developers predict Amulet battery lifetimes and understand how their decisions affect those lifetimes. 4) An open-hardware wearable in a smart watch form-factor, with a

[1]The open-source, open-hardware release of the Amulet platform and its tools can be found at
`https://github.com/AmuletGroup/amulet-project`

SenSys '16 November 14-16, 2016, Stanford, CA, USA

ACM ISBN 978-1-4503-4263-6/16/11.

DOI: http://dx.doi.org/10.1145/2994551.2996527

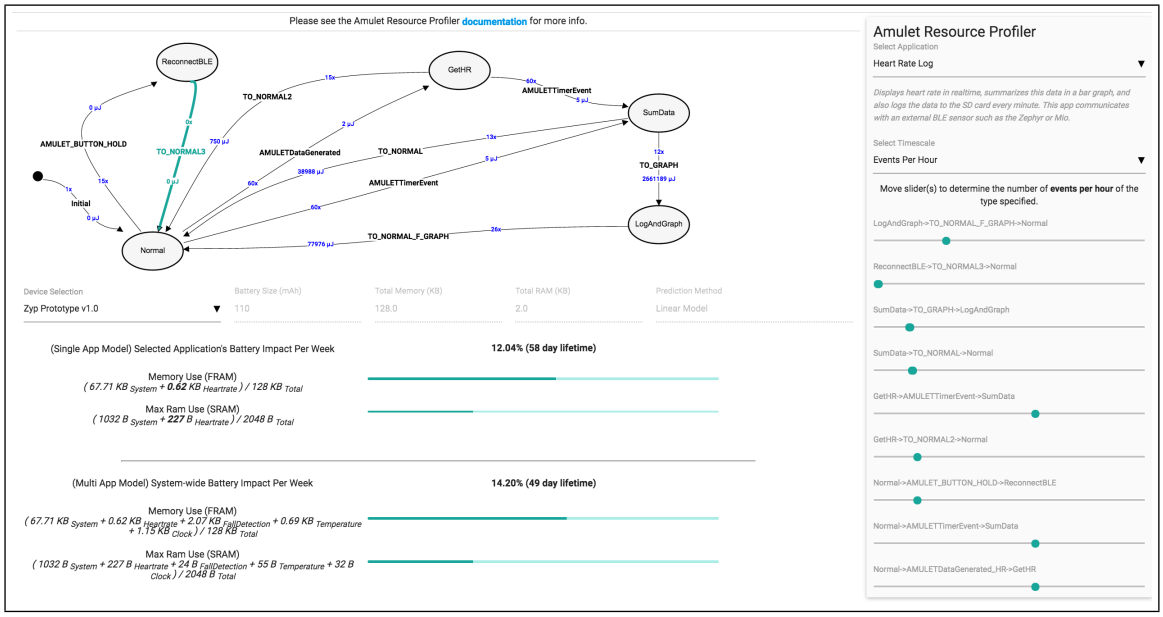

Figure 2: Screenshot of the ARP-View tool. A selected application is rendered on the screen where the transitions have been annotated with both the estimated cost of executing that transition and the rate at which the transition executes. The sliders along the right-hand side of the window allow the developer to adjust the rate of specific transitions. The bottom area of the screen displays information about an application's impact on the overall battery lifetime per week and memory usage. To view a full-size interactive demo of ARP-View, please visit `https://arpview.herokuapp.com/`.

variety of sensors and user interface mechanisms, and support for BLE communications with networked body sensors.

We envision the Amulet Platform as being broadly applicable to those in the sensing communities, as well as domain scientists and practitioners in human-centered fields like health and fitness. With the Amulet Platform, the health-behavior science community has a new tool with which researchers can field long-duration experiments on human subjects in a wide variety of studies. We have provided the entire Amulet Platform as an open-source, open-hardware alternative to the available commercial platforms that have so far been used for wearables research. We imagine that these tools, development methods, and techniques, could also be applied broadly to applications in the wireless sensor networks community. Amulet is not a single system – it is a novel approach to developing long-lived wearable platforms that is suitable for a wide spectrum of multi-application wearable devices.

2. DEMONSTRATION

This abstract details a demonstration of an associated paper at SenSys 2016[1]. We will demonstrate two core parts of the Amulet platform; the ARP-View tool (shown in Figure 2), and the wearable hardware in watch form-factor (shown in Figure 1). We will be wearing the Amulet—loaded with multiple applications described in[1]—and provide Amulets for others to try out. We will show how to use the ARP-view tool on a desktop or laptop on our station. All the apps built for the Amulet Platform will be pre-loaded onto the ARP-view tool. Anyone will be able to observe each applications state machine, move sliders based on frequency of events, and view the expected battery lifetime of the Amulet based on their decisions.

3. ACKNOWLEDGMENTS

This research results from a research program at the Institute for Security, Technology, and Society, supported by the National Science Foundation under award numbers CNS-1314281, CNS-1314342, and TC-0910842, and by the Department of Health and Human Services (SHARP program) under award number 90TR0003-01. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the sponsors.

4. REFERENCES

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